RANCH DAY

OCTOBER 12, 1953

New Mexico Experiment Station, New Mexico Extension Service
Southwestern Forest and Range Experiment Station

Proper Nutrition —— A Good Investment

Experimental Ranch

New Mexico College of A. and M. A.

Jornada Experimental Range

Southwestern Forest and Range Experimental Station

PROGRAM

THIRTEENTH ANNUAL RANCH DAY

October 12, 1953

Ivan Watson, New Mexico Extension Service, Presiding

8:00 a.m. Leave Dona Ana County Courthouse, Las Cruces, New Mexico

8:35 Pasture 6, Jornada Experimental Range
The use of molasses on tobosa grass--Harold A. Paulsen, Range Conservationist, Jornada Experimental Range.

9:20 Pasture 10, Jornada Experimental Range
Better cattle distribution through the use of meal-salt mix--Fred N. Ares, Superintendent, Jornada Experimental Range.

10:15 Pasture 2, College Ranch
Mesquite invasion--J. J. Norris
Mesquite control--K. A. Valentine

11:30 Headquarters, College Ranch
Lunch

12:45 p.m. Welcome - President John W. Branson
Raymond Price, Director, Southwestern Forest and Range Experiment Station

Introduction of Guests

1:00 Address--Ed Heringa, President, New Mexico Cattle Growers Association

1:20 Some things I have learned about ranching--Frank S. Boice, Empire Ranch, Sonoita, Arizona

1:40 Urinary calculi in cattle--Dr. H. R. Crookshank, Nutritionist, Pan Tech Field Laboratory, Amarillo, Texas.

2:20 Pasture 1, College Ranch
Supplemental feeding of carotene for breeding cows during pre-calving and calving period--W. E. Watkins
Observations on salt and meal feeding--J. J. Norris

3:20 Camp Well, College Ranch
Inspection of experimental steers and replacement heifers--Robert L. Blackwell
Supplements for range cows--J. H. Knox

JORNADA EXPERIMENTAL RANGE

Jornada H.Q.

16

Mayfield Well

3

Camp Well 4

Stop 5

9

2

5

15

Co-op Well

10

Stop 4

Stop 2

17

Stop 3

6

14

Seldon Well

College H.Q.

Lunch

South Well

6a

12

9

8

13

Summerford Mt.

10

Stop 1

Radium Springs

Las Cruces

1 2 3 4

Miles

Section of College Ranch and Jornada Experimental Range showing Ranch Day route, 1953

Legend:

Division fence

Route

Boundary

0 Well

9 Pasture Number

* Stop

THE USE OF MOLASSES ON TOBOSA GRASS

By Harold A. Paulsen, Jr.

Management plans for many ranch operations in southern New Mexico, Arizona, and west Texas must include the use of tobosa grass. On some ranches it is the principal source of forage. On those areas where it is only of minor importance, certain management practices may still be justified to more completely utilize the large amounts of forage which tobosa produces. One promising solution to the problem of increasing the use of tobosa grass is the subject of this paper.

Characteristically, tobosa occurs on the fine, somewhat compact soils of the flats or swales and to a lesser extent on similar soils in the foothills. It attains its best development on areas subject to occasional flooding. Although not an aggressive seeder, the strong root stocks provide a vigorous means of reproduction and enable the plant to resist trampling and act as an effective soil binder.

Tobosa often greens up in the spring if moisture is available. However, most of its herbage is produced in the summer after temporary flooding. At this time it is readily taken by cattle. If moisture is not limiting, tobosa grass continues to grow vigorously throughout the summer months, often producing more forage than grazing animals will harvest. When grazed at this time it has been learned that tobosa withstands grazing of 60 percent of its herbage production without injury to the plants. However, unless frequent moisture is received, the plants soon become dry and will be taken only if cattle are held on the area. Thus, it has been essential to make full use of tobosa during a relatively short period if its full value is to be realized.

Tests at State College have already shown that the nutritional value of tobosa compares favorably with black grama during its flush of growth. Crude protein content is higher and fiber content lower in tobosa than in black grama at this time. Further it was demonstrated that gains of cows and calves are higher on tobosa range than on adjacent black grama areas during the summer period.

After maturity, the nutritional value of tobosa declines with its palatability. Research has shown, however, that when supplemented with cottonseed cake mature tobosa forage provides suitable roughage from a nutrition standpoint. However, the grass at this stage is unpalatable to cattle unless they are forced to graze it.

On the Jornada Experimental Range approximately one-third of the total forage resource is furnished by tobosa grass. Because many of the highly productive tobosa swales are small in area, it is impossible to fence each of them. Consequently, the cattle soon leave the swales when the tobosa begins to dry to graze the adjacent more palatable black grama. Occasionally, the tobosa type occupies an area sufficiently extensive to warrant fencing and handling as a separate pasture such as pasture 6 on the Jornada.

Management practices such as salting, closing of permanent water, and development of small surface tanks for temporary water are partially successful in holding the cattle on the tobosa areas. However, in most summers during intermittent dry periods, the cattle will drift to other areas until the tobosa again freshens up with additional moisture.

Aside from the need of reserving black grama ranges on the Jornada for the winter and spring periods, incomplete utilization of tobosa hampers subsequent use of forage the following year because of the rank, coarse old growth. Burning of the carry-over forage provides an effective means of eliminating the excess herbage. Frequently, however, the stand is reduced if the fire is too hot, especially when the grass is burned in the spring. When the above-ground portion is entirely consumed, the soil is exposed to wind erosion.

Previous studies of cutting tobosa grass for hay before it reaches maturity in the summer offers another possibility for providing fresh growth the following year and making better use of the tobosa. It was shown that when tobosa is cut while green and succulent it furnishes valuable feed that compares favorably with good quality prairie hay. Hay cuts averaged about one-half to two-thirds of a ton per acre on the test plots. Cattle consumed the hay readily after the range feed became dry and continued in good condition throughout the winter.

The use of molasses sprayed on standing tobosa herbage suggested another possible means of utilizing the large amounts of forage it produces. Cattle are known to have a pronounced sweet tooth and exhibit a preference for otherwise unpalatable forage if it is combined with some sweetening material. Thus molasses sprays on stubble fields, windrowed harvester chaff, and various types of hay is a common practice in many areas. Not only has this proven to be profitable for increasing the palatability and consumption of this type of material but also it has been a means of providing pasture animals with a concentrate supplement with an economy in labor since it eliminates baling and/or hauling for storage. Synthetic sweeteners such as saccharine, which has no nutritional value, are apparently as effective in attracting the cattle as molasses or other supplements with a sweet taste.

The use of molasses on tobosa grass has been tested on the Jornada primarily to secure better use of the range forage rather than as a means of providing a concentrate. No attempt was made to evaluate the nutritive aspects of the spraying in the current tests. Additional work may prove this technique to be an effective means of providing supplements as well as increasing the use of the available roughage.

The molasses spray tests which were made on the Jornada have been conducted at two different periods of the year at four concentrations of molasses. The first spraying with cane molasses at one concentration was made last winter on a small tobosa area adjacent to a temporary water. The grass at that time was coarse and had not been noticeably grazed. Immediately after spraying, 7 head of cattle were moved to the area and allowed free grazing choice on the sprayed and adjacent unsprayed check plots. After 21 days, when utilization of the sprayed plots was estimated to be about proper, the cattle were removed. Grazing had been uniform over the sprayed plots but little if any of the unsprayed tobosa had been taken. The line separating the two plots was clearly distinct indicating that the cattle confined their grazing to only the sprayed plots.

In this application 45 gallons per acre of the molasses-water solution was sprayed on the grass stems and leaves. The solution contained 22.2 gallons of molasses which is equivalent to 266 pounds of molasses per acre.

Results of this initial spraying appeared so promising that extension of the spraying was undertaken late this summer with improved spray apparatus and a wider range of solutions. The intent of this work was to prolong the period of summer grazing on tobosa by spraying it with molasses as soon as it showed evidence of maturing.

Four 1-acre plots were staked out and three of these were sprayed and one was reserved as a check. The solutions which were applied were 10, 20, and 35 percent molasses in water. In spraying the plots, an orchard-type spray unit was used. The sprayer was mounted on a pickup with the outlet pipe extending from the back of the bed. A nozzle tip with two outlets projected the solution over a 20-foot swath when the pump was delivering approximately 40 pounds pressure at a rate of 4 gallons per minute. The volumes applied to each plot averaged 50 gallons per acre. Traveling in low gear at approximately 4 miles per hour permitted coverage of each plot in about 15 minutes. Cost of the molasses for the heavy application averaged $6 per acre.

The results obtained from this spraying were largely negative insofar as obtaining any increased use of tobosa grass. There was

no noticeable grazing preference for any of the forage on the sprayed plots in comparison to the unsprayed check plot. A complete explanation of this failure to increase the palatability on the sprayed plots is lacking until further evidence is accumulated. However, it is believed that in part it can be attributed to the fact that there was an abundance of still fresh tobosa nearby which apparently was equally as attractive as the sweetened tobosa. In addition, the cattle which drifted on to the spray areas had had access to an abundance of green feed and were not particularly hungry at the time. In contrast, during the winter green feed was gone and the cattle readily accepted the molasses-sprayed forage.

Wood molasses, which shows promise in feedlot operations, was tested as a tobosa spray on the Jornada a year ago. Feeding tests had established the feed value of wood molasses as equivalent to cane molasses but this was the first attempt in its use as a pasture spray.

Failure of the cattle to show any preference for the wood-molasses-sprayed tobosa was at first attributed to the bitter-sweet taste. However, when considered in the light of this year's findings with cane molasses, further tests seem warranted at other periods of the year.

The late summer spraying has provided information on the methods of spraying tobosa, suitable spray apparatus to use, and the time of spraying. Subsequent work will profit from these late summer trials and tentative suggestions for the use of molasses on tobosa grass can be made on the basis of these findings.

Anyone contemplating a spraying program on tobosa grass should plan to spray areas only large enough to carry the cattle for approximately a week. If larger areas are sprayed, there is always the possibility that dust or rain may annull the efforts and expense of the spray application. Spraying smaller areas provides the animals with a fresh source of molasses-sprayed herbage.

When cattle are to be placed on sprayed forage for the first time, it is well to move them on the area immediately after spraying when the forage is sweetest. Even then it may be necessary to hold the animals on the area until they begin grazing and acquire the taste of the molasses. This is particularly important if the cattle are well fed when they are placed on the area.

BETTER CATTLE DISTRIBUTION THROUGH THE USE OF MEAL-SALT MIX

By Fred N. Ares

Better Distribution of Grazing Needed

Since the beginning of the experimental work on the Jornada Experimental Range, the distribution of livestock has been recognized as one of the chief problems of range management. Cattle overgraze easily accessible range in the vicinity of permanent watering places while the more remote areas are only lightly grazed or untouched altogether. Somewhere between is a zone of proper grazing in which the maximum use of forage is obtained that is consistent with the requirements for maintenance of the forage plants.

Many methods have been used on the Jornada to obtain better distribution of livestock on the range and a more uniform pattern of grazing use. Salt placed on lightly grazed areas instead of near permanent water, closing of permanent waters when temporary water is available, riding, and herding are employed to scatter cattle over the range and minimize concentration on certain localized areas. These measures are helpful and are recommended as good management, but they have been only partially successful in alleviating the distribution problem.

With the introduction of the meal-salt mix an additional means of obtaining better distribution became available to the stockman. This mixture can be fed on the open range in contrast to other supplements or concentrates which must be hand-fed in corrals. The salt content regulates the amount of concentrate consumed by the animals and can be varied to meet individual requirements.

Plan of the Study

A study was initiated on the Jornada Experimental Range in 1949 to determine the effectiveness of the meal-salt mix in controlling distribution of cattle. Pastures 9 and 10, which are typical of the valuable and extensive black grama range type of southern New Mexico were used. Almost all of the forage in these two pastures is provided by black grama, and in accordance with its growth requirements, grazing is confined to the winter-spring period.

The pastures are level mesa range and all parts are easily accessible to livestock. Permanent water is provided by wells located in the north and south ends of each pasture. The maximum distance from water was 3 miles and the average maximum for both pastures about 2¼ miles. The area of pasture 9 is 3,172 acres and of pasture 10, 7,172 acres.

Pasture 9 was stocked with yearling heifers and pasture 10 with yearling steers. This was necessary because it is not desirable to mix the two classes of yearlings. Differences in the grazing habits and ability to gain were compensated for by reversing the feeding method in the pastures the second year of the study.

The supplemental ration for the test feeding was approximately 80 percent meal and 20 percent salt. This mixture regulated the consumption at about 1½ pounds of meal per head. The low salt content also increased the attractiveness of the mix and decreased the danger of salt poisoning.

The study was started by placing feeding sites in pasture 9 both at and away from water; and away from water, only, in pasture 10. Thus, in pasture 9, eight feeding sites, two at water and six away from water, were established in 1950. In 1951, a total of seven sites was used in this pasture, all from 1/2 to 1-1/2 miles away from water. For pasture 10, seven sites were used in 1950 ranging from 3/4 mile to 3 miles from water. In 1951, nine sites were used, two of which were at water and the others at the same location used the year before.

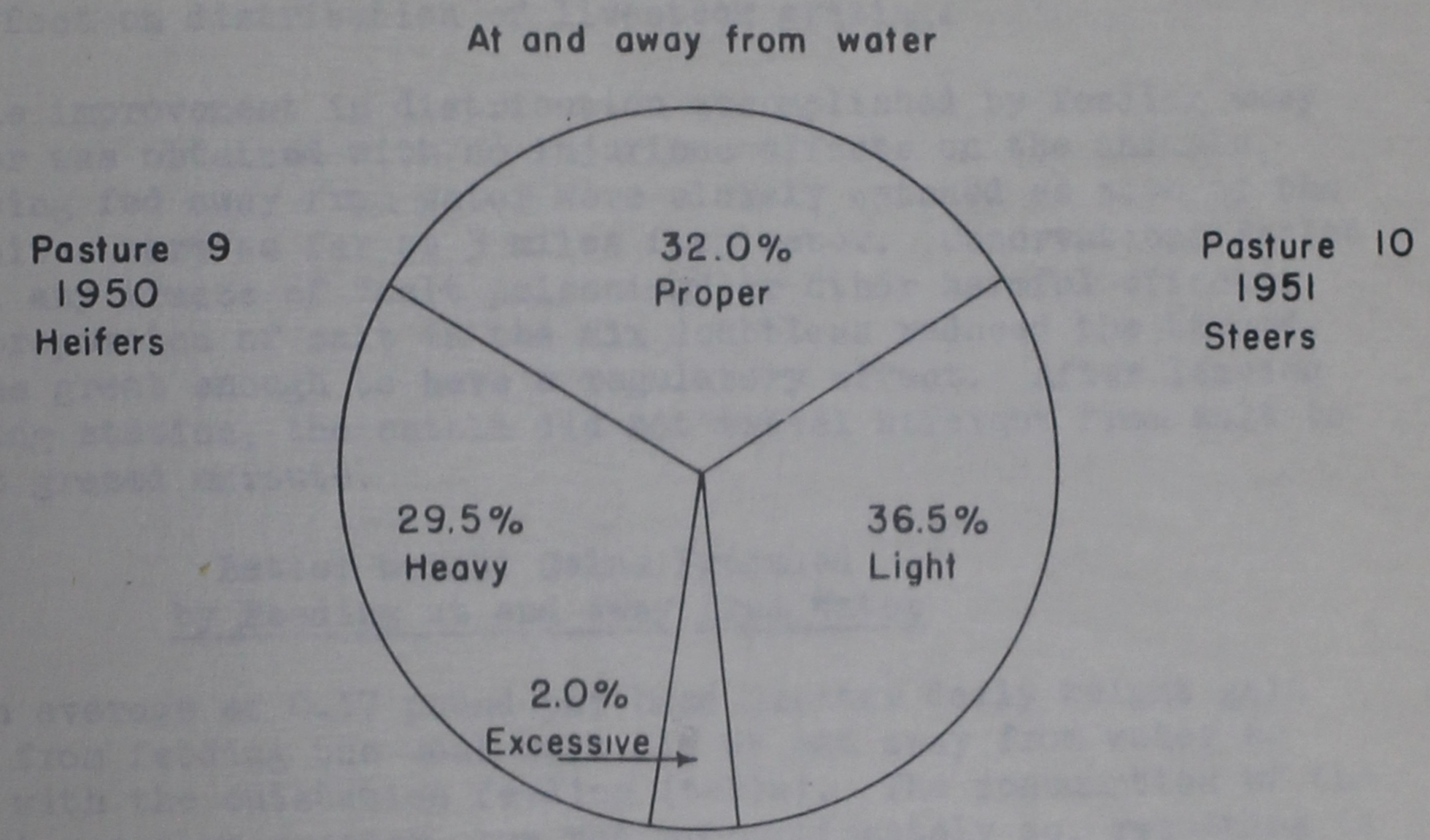
The pastures were stocked as closely as possible to the grazing capacity as determined by a forage inventory completed each year just before stocking the pastures. Utilization measurements, made at the close of the grazing year, provided the basis for mapping the pastures into use zones to show the grazing pattern.

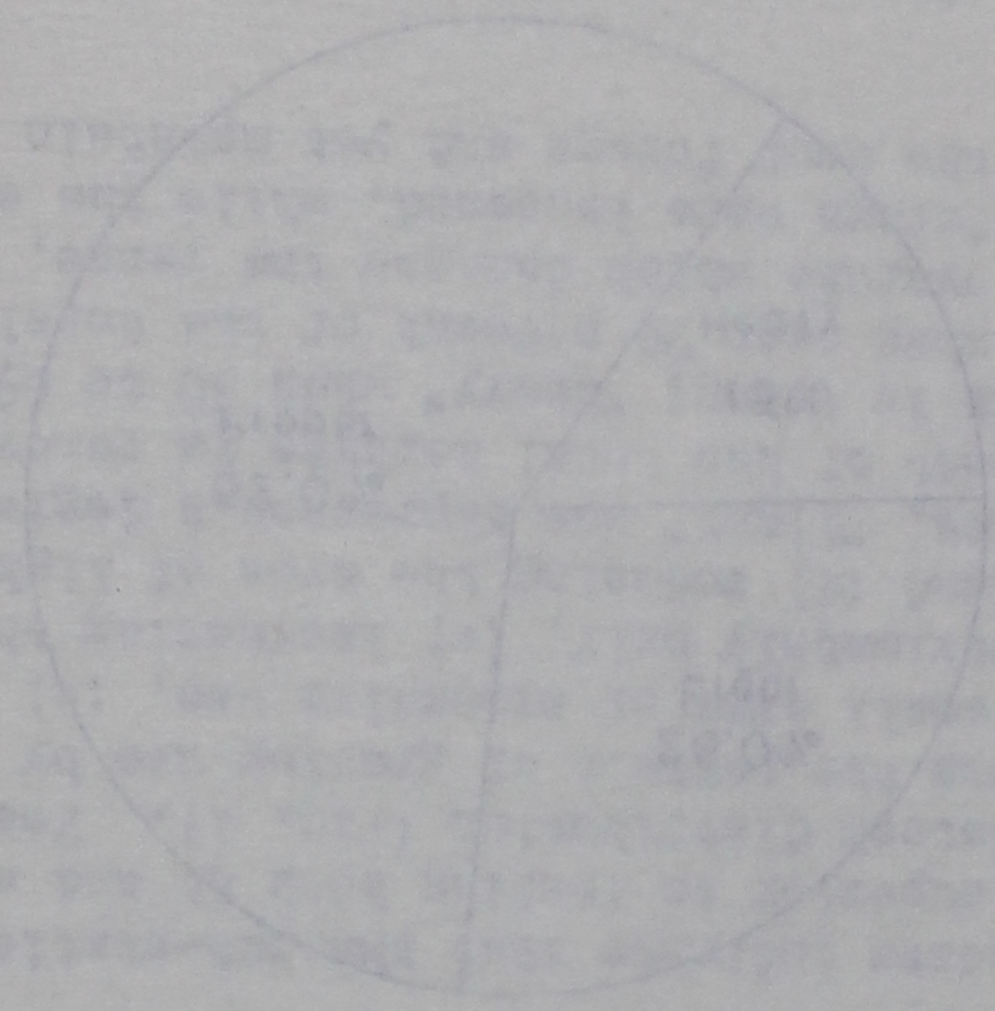
Use Pattern Improved by Out-station Feeding

The tests indicate that the out-station feeding of the meal-salt mix is superior to feeding both at and away from water for improving livestock distribution (fig. 1). Feeding away from water, only, improves the pattern of grazing use by (a) essentially eliminating the small area of excessive use, (b) reducing the heavy-use zone by approximately half, (c) increasing the properly used area by 84 percent, and (d) reducing the area of light or no use by 29 percent. (In these data, "light" use expresses a degree of grazing when less than 30 percent of the total herbage is removed; "proper" when 30 to to 49 percent is taken; "heavy" when 50 to 69 percent is grazed; and "excessive" when over 70 percent of the total volume is grazed.) Thus, the area of overuse which damages the range, and the areas of underuse which waste forage were lessened, while the area used to a degree that would yield the most forage and yet maintain the valuable grasses was increased.

In feeding at and away from water most of the supplement, about 80 percent, was taken from the troughs located at water. The out-station sites were not effective in attracting the yearlings as long as the mix was available at water. This resulted in increased

Figure 1. Comparative patterns of grazing use from the meal-salt feeding tests.





trampling and local overgrazing. The common practice of feeding the meal-salt mix entirely at water would have an even greater detrimental effect on distribution of livestock grazing.

The improvement in distribution accomplished by feeding away from water was obtained with no injurious effects on the animals. Cattle being fed away from water were closely watched as some of the feeding sites were as far as 3 miles from water. Observations failed to reveal any traces of "salt poisoning" or other harmful effects. The low proportion of salt in the mix doubtless reduced the hazard, yet it was great enough to have a regulatory effect. After leaving the feeding station, the cattle did not travel straight from salt to water but grazed enroute.

Better Weight Gains Produced by Feeding at and away from Water

An average of 0.17 pound per head greater daily weight gain resulted from feeding the meal-salt mix at and away from water as compared with the outstation feeding (table). The consumption of the supplement was also greater, but not proportionately so, resulting in more efficient gains per pound of feed used. Gain per pound of feed averaged 0.07 pound or about 35 percent more than in the out-station feeding.

Table--Comparative weight gains obtained from two methods of feeding meal-salt mix, Jornada Experimental Range

Pasture No.	Grazing year	Average total gain	Average daily gain	Total feed consumed	Daily ration	Gain per pound of feed
		(Lbs/head)	(Lbs/head)	(Lbs/head)	(Lbs/head)	(Lbs)
9	1950	57.1	0.46	247	1.99	0.23
10	1951	51.2	.32	289	1.85	.17
Average, fed at and away from water		54.1	.39	268	1.92	.20
10	1950	22.5	.17	244	1.88	.09
9	1951	44.2	.27	241	1.48	.19
Average, fed away from water, only		33.3	.22	242	1.68	.13

These findings are in accord with expectations. Maximum rate and efficiency of gain would result if the yearlings obtained all of

their nutrients at water and had to expend no energy in foraging. In this case, the meal-salt mix would provide all of the ration and would not be considered a range supplement. This would be a feedlot operation.

The objective of sound range livestock operations is twofold; to maintain and efficiently use the range, and at the same time maintain normal growth and condition of animals. The need for and value of range supplements varies with weather and forage conditions, but in most winters some supplements are desirable. Heifers wintered without supplements lost an average of 14.2 pounds per head in 1950 and gained 16.2 pounds per head in 1951. This study indicates that meal-salt mix placed away from water will not only favor uniform grazing but will also promote satisfactory growth of weaner calves and bring replacement heifers through the winter in good shape.

MESQUITE INVASION

By J. J. Norris

One of the more important problems facing the livestock industry in the Southwest is the invasion of grassland by mesquite. The problem is not a new one although its severity has become more and more apparent in recent years. To indicate that mesquite invasion is a problem of long standing, one need only to read the reports of far-sighted individuals who were pointing to brush invasion of rangelands as a definite problem before 1900. Doubtless the early stages were slow in nature and scarcely noticeable to any except the most observant. However, as mesquite plants became more numerous in grassland they provided additional seed crops and the result is an ever increasing number of plants year after year.

Here on the College Ranch we have been watching mesquite take grassland away from us for several years and have been collecting data on the rate of mesquite increase. One set of data is based on a belt transect 203 rods long by 1 rod wide which begins in a mesquite dune area and extends into grassland. Periodic charting of all mesquite plants on the transect has given a good picture of the number of plants and the area occupied on a per acre basis. These data covering a 12-year period are shown in Table 1.

Table 1.--Mesquite on per acre basis computed from 203-rod belt transect

	Year			Increase		
				7-yrs.	5-yrs.	12-yrs.
	1940	1947	1953	1940-47	'47-53	1940-53
Mesquite-Dune Type						
No. plants	150	248	283	98	37	135
Crown spread (sq.ft.)	3900.7	6463.3	7406.6	2562.6	943.3	3503.9
Grassland Type						
No. plants	114	262	301	148	39	187
Crown spread (sq.ft.)	729.8	2043.4	2349.2	1313.6	305.8	1619.4

In the first 7-year period the number of mesquite plants increased 65 percent in the dune-type and 130 percent in the grassland. Rate of increase in the following 5-year period was considerably less

and amounted to 15 percent in both types. Increases in plant numbers over the full 12-year period were 90 percent in the dune-type and 165 percent in grassland. The lesser rate of increase during the second period is probably due to the shorter period, the areas are becoming fully occupied, and a result of the severely dry years which prevailed during the period.

Size of individual plants also increased greatly as shown by crown spread measurements. The area occupied by mesquite crowns in the dune-type nearly doubled over the 12-year period and more than tripled in the grassland. Crown spread alone is, of course, not the complete picture. The influence of the widely spreading mesquite root system in affording competition and thereby reducing the stand of surrounding desirable vegetation may be of much more importance than crown spread. Another factor of great significance is the tendency for soil movement to commence as mesquite thickens up and grasses pass out of the picture. The end result is the formation of a blowing or dune area which is most difficult to bring back into production since it involves not only removal of the brush but also stabilization of the moving soil and returning the native grass species to full cover.

The real significance of mesquite invasion is best shown by its effect on forage production and some observations are worthy of note at this point. Clipping of forage grasses in an area of former grassland now heavily occupied by mesquite yielded only $6\frac{1}{4}$ pounds per acre. A similar area where the invasion is in the early stages yielded 228 pounds per acre. It becomes obvious that increasing mesquite means decreasing grass and, hence, a decrease in livestock production. It is true that mesquite has some value, however, few people rate it the equal of the grass which it replaces. For those who feel that they want to keep some mesquite, we might ask if it is possible to keep a little of it without ending up with a solid stand. The problem might be something like having a small fire in a haystack and still keeping the haystack.

The increases in mesquite, which the data here presented show, have occurred under a conservative stocking program and it seems apparent that grazing management is not the answer to the mesquite problem. Some active program of eradicating mesquite is necessary and the next discussion will cover some of the results of our studies on this subject.

REVIEW OF RESULTS OF MESQUITE CONTROL EXPERIMENTS ON THE COLLEGE RANCH

By K. A. Valentine

We have seen from the previous talk that mesquite is encroaching at a relatively rapid rate into some of our best grassland range and that we lose practically all of the grazing value from the grassland range once the conversion to mesquite brush is complete. We can not overemphasize the importance of recognizing this fact and taking all possible steps to prevent the conversion of good productive grassland to the all but worthless mesquite type. In this connection it should be pointed out that there is no promise whatever that we can restore the fully developed mesquite brush range to a productive grass cover. The only solution to the problem is prevention.

The experiment station has been doing work aimed at developing an effective method of mesquite control for the past several years. While we have not yet found a method of killing all mesquite brush on the range at a single operation, certain treatments do give promise of being successful in control.

Most of our experimental work has been done with chemical control methods and again most of this work has had to do with the plant hormone-like chemicals 2,4-D and 2,4,5-T. Our earlier work showed that 2,4,5-T was much superior to 2,4-D in mesquite control under our conditions, so that we are doing most of our present work with 2,4,5-T. The work now consists principally of tests on different formulations of 2,4,5-T and 2,4-D - 2,4,5-T materials added to the formulations, concentration or strength of material used and season of year and year of application. All these tests are made by the foliage spray method, using ground equipment.

It should be borne in mind that the full or final effect of treatment of mesquite with this kind of chemical is often very slow in developing. Sometimes continued effect is still noticeable in the second year after the year of treatment, that is as long as 20 to 24 months or more after original treatment. This means then that all the data for the more recent years is tentative to a certain degree. For the same reason results of our 1953 work are not included in the present discussion.

It is worthy of note, too, that results have been influenced by marked variation in effect of 2,4,5-T within experimental treatments that are identical or nearly so. This is thought to be due to variation in phenology, insect, rabbit, and wind damage (windburn) of leaves between individual mesquite plants themselves. Whatever the cause, or causes, may be they have made it difficult and impossible in some

instances to discriminate with certainty between treatments with respect to their control value. Because of the variability further testing is needed along each of the lines now being followed.

The formulation tests have shown that of the materials used the low volatile esters of 2,4,5-T have yielded the best results. The materials used and results obtained are shown below:

Material	Percent Complete Kill 1951	1952	Av.
Propylene glycol butyl ether esters of 2,4,5-T (low volatile)	50	62	56
Propylene glycol butyl ether esters of 2,4-D and 2,4,5-T (low volatile)	38	36	37
Isopropyl ester of 2,4-D and 2,4,5-T	--	35	--
Isopropyl ester of 2,4,5-T	38	50	44
Tetrahydro furfural ester of 2,4,5-T (low volatile)	--	57	--
Ethyl amine of 2,4,5-T	18	35	26

Here the indications that the low volatile esters of 2,4,5-T without additions of 2,4-D yield best results under our conditions.

The additive tests have been carried on with the objective of determining whether or not the addition of other materials to the sprays will increase their effectiveness. So far results have been somewhat conflicting or have shown no clear-cut indication that any of the materials added produced worthwhile increases in effectiveness. Results of the test are presented below:

Additive	Percent Complete Kill 1951	1952	Av.
None; 2,4,5-T only	40	28	34
Emulsifier	55	22	38
Emulsifier + 2% nontoxic oil	52	22	37
Emulsifier + 4% nontoxic oil	43	37	40
Emulsifier + 8% nontoxic oil	42	37	38
Emulsifier + 1% pentachlorophenol	--	23	--
Emulsifier + 2% pentachlorophenol	--	33	--

Results of concentration tests are as follows:

Concentration 2,4,5-T in percent of parent acid	Percent Complete Kill 1950	1951	1952	Av.
.05	8	--	--	--
.10	13	65	65	48
.15	36	70	72	59
.20	40	58	58	52
.25	--	45	75	60

While these results are somewhat conflicting, they appear to indicate that concentrations of 0.05 percent are too low for worthwhile results and that no worthwhile increase in kill is obtained by increasing concentration above 0.15 percent.

Tests to determine time of year when spraying is most effective, have consistently shown that this is an important factor in obtaining good results. Average kills at semimonthly intervals are shown below:

	May		June		July		August	
Time	Early	Mid	Early	Mid	Early	Mid	Early	Mid
Pct. complete kill	2	38	61	45	26	28	32	13

The period of highest kills is actually rather limited, perhaps not extending over 2 weeks, roughly including the last week in May and the first week in June. Before this time, lack of complete sprouting and leaf development appears to greatly limit success and after this time, as yet incompletely understood factors reduce effectiveness of the spraying. While it has happened during the past 4 years that best results have been obtained in early June, it is of course true that effects are associated with varying phenology and physiology of the plants and not with calendar dates as such. In terms of phenology the highest kills have occurred immediately after the leaves have made their full development. Flowering may be in various stages from early bud to full flowering. Fruit may be elongated to full length but is flat and quite green, not showing the thickening and lightening in color as it does later.

We have observed some later increases in kills following the declines after early June which are associated with the occurrence of summer rains. Generally results have not been as good as those of early June. However, we have not experienced good heavy summer rains during the period of the study and cannot say just how such rains would affect results. Presumably they might make possible kills as good as those of the early growing period.

Results have been found to differ from year to year, apparently depending upon the amount of precipitation received in the late winter and spring period just prior to spraying. Such results are shown in the following data:

Precipitation Jan. - May	Year	Highest percent complete kill from season tests (early June)
0.14 inch	1950	52
.90 "	1951	50
1.49 "	1952	59
2.68 "	1949	92

While it is true that 1950 produced higher results than the rainfall would seem to warrant, or 1951 lower results, there is a consistent increase in kill with increase of rainfall in 1952 and 1949. The average precipitation for this late winter-spring period as computed from three of our rain gages with a 23-year record is 1.70 inches. The indications seem to be that rainfall for the late winter-spring period will have to be at least average or possibly something in excess of average in order to obtain the high level results we think we should get in field scale control. The 23-year record from the three stations mentioned above show that only 9 years (averaged for three stations) in the 23-y ear period were average or above. If it turns out that rainfall requirement for high level effectiveness has to be as high as 2.50 inches in the late winter-spring period, then the number of favorable years will be markedly reduced, as the record shows only 3 such years in the period (average for the three stations). While it may be unfortunate that so high a proportion of years are apparently unfavorable for good results, it is to our advantage to be able to identify the favorable years, on the basis of rainfall, when good results are probable and to carry on extensive or field scale control work only in the more favorable years.

Another factor that has been found from general observations to be very important in obtaining good results is complete coverage of plants. Any branches or even smaller twigs that are not covered by the spray fail to die and of course serve to regenerate the whole plant in the course of time.

In addition to the experimental work discussed we have done a limited amount of field scale work patterned on the small scale experiments in order to determine results and costs on a more extensive basis. Results of this work together with results of early June season test results for comparative purposes are presented as follows:

Year	Date(s)	Kill	Kill of early June Season Treatment
1950	June 13 to 22	41	57
1951	June 5 to 19	38	50
1952	June 19	36	59

The field scale results are in each case materially below those of the smaller experimental plots. This is perhaps explained for the most part by the fact that the field scale work was done later, that some plants were entirely missed in the field scale work, a rarity in the season experiment plots, and that parts of plants were more frequently missed on the field scale plots. Although results probably would have been better had the field scale work been done in early June, it is also probable that missed plants and parts of plants will always cause the more extensive type of work to show poorer results than the more carefully controlled experimental work. In 1949 work had not progressed to a point warranting the more extensive trials, hence comparable data are not available for that year.

Costs of doing the work on a field scale basis have been computed at $1.64 per acre, broken down into $0.54 for materials, $0.90 for labor, and $0.30 for equipment. This work was done with a crew of three: two sprayers and a driver. Such a small amount of this type of work has been done that the cost indicated must be considered as only approximate.

Perhaps it is in order to touch briefly on standards of success. These will vary in different parts of the southwestern range country, depending on costs, productivieness of the range, response of grasses to the mesquite control, type of damage done by mesquite, etc. In much of central Texas, for example, where the range is potentially more productive than ours, where grass responds readily to the reduction in mesquite competition and where dense thickets of mesquite make working livestock difficult, they appear to consider that a job which kills the greater part of the tops and thus opens the mesquite up for grass growth, grazing, and stock working is successful.

In our area, however, we are not so much concerned with these kinds of results. Our chief concern is prevention of almost complete loss of our range values at a cost that is commensurate with those values. We must have a relatively high percent kill in order to consider a control method successful and, of course, cost must not be prohibitive. Just what this percent is we cannot say at the present. Except in the cases of a few of the small scale experimental treatments we do not believe that our results are as good as they should be. Nor do we believe they are as good as they might be if we take

care to do the best job we know how. This includes use of the right material at the right concentration, in the right way, in the right season, and right year. It does appear, however, that where isolated plants and small isolated stands of mesquite are producing seed which is infesting larger range areas not now containing mesquite, the presently attained level of effectiveness on a field scale basis and the associated cost is warranted because the work might very correctly be considered as applying in a defensive way to the larger area. This reduces the cost on a unit area basis. This might well be true even considering the need of later follow-up treatments to complete the control work.

In closing this discussion we would like to leave these general points in your minds:

First, mesquite is a species of plant that will not yield to good grazing management, that is, proper grazing use of the range alone. It has increased on well managed range as well as on range that has been abused.

Second, this type of direct or positive control work is quite properly to be regarded as a sound and essential range management practice. Time was when "grazing management" was the only type of range management. Now with demand for range and range products high and range limited, we must use more intensive management practices in order to preserve and improve the range.

Third, we cannot afford to delay the undertaking of control work when it is feasible to do it. Mesquite is steadily encroaching on good grassland range. While there will undoubtedly be improvements in materials and methods and perhaps reduction in costs there is no reason to believe that a control method will be worked out that is far below present costs. It is going to cost to get the job done and delaying the doing of it will only increase its ultimate size and cost, if indeed it does not permit the invasion and deterioration to go past the "point of no return," i.e., when the residue of better grass is so sparse it will not recover at all.

SUPPLEMENTAL FEEDING OF CAROTENE FOR BREEDING COWS DURING PRECALVING AND CALVING PERIODS

By W. E. Watkins

The study of carotene and vitamin A for range cattle was started at this College in 1936. For 5 years two of the principal grasses were analyzed each month for their carotene content. It was found that many grasses lost all of their carotene during the winter but that some retained a part of their carotene. It was also found that browse plants were a rich source of winter carotene.

In 1950 results were published at this station giving the results of blood, vitamin A, and carotene analyses of Hereford cows grazing on this college range. This was taken each month for over 5 years. The blood plasma carotene values were rather high and satisfactory except for two years when the carotene levels were near the danger line. These low periods were terminated usually in May, largely because of the presence of annual weeds and members of the mustard family during March and April. The lower blood values for these two years raised a question as to whether there might be a carotene deficiency in certain years. To study this problem a new project was started which was to determine the effect of supplementing dormant range with feed rich in net energy, dig protein, and carotene.

During the four weeks before calving, one group of 25 cows were fed one pound of cottonseed meal daily. The other group of 25 cows was fed 1¼ pounds of a mixture of 23 parts dehydrated alfalfa meal, 70 parts cottonseed meal, and 7 parts molasses. Feeding started about a month before the beginning of calving, which was usually about March 15. At the advent of calving these daily amounts of supplements were doubled for both groups.

The data obtained represents one sampling before calving and two samplings after calving. Various workers have produced normal health and production with aged cows with 83 micrograms of carotene while a heifer should have at least 118 micrograms. The carotene data presented in table 1 represents the average of over 600 blood tests.

The blood carotene according to the data in table 1, which includes 12 or more cows in each group, is well above the requirements in all instances. This carotene is generally lower during March but usually reaches rather high levels as the young plants and grass appear. The feeding of the alfalfa cube which furnished 0.29 pounds of dehydrated alfalfa meal before calving and 0.58 pounds after calving did not increase the blood plasma carotene of these cows over that of the cottonseed meal fed cows. There is no significant difference in the blood carotene between the cottonseed meal fed cows and the alfalfa cube fed cows.

Table 1.--Average blood plasma carotene values of Hereford breeding cows during the precalving and calving periods

Year		March	April	May
1946	Plasma carotene, cottonseed meal fed cows 1/	288	653	582
"	Plasma carotene, alfalfa cube fed cows	324	647	599
1947	Plasma carotene, cottonseed meal fed cows	651	642	603
"	Plasma carotene, alfalfa cube fed cows	669	606	535
1948	Plasma carotene, cottonseed meal fed cows	398	454	673
"	Plasma carotene, alfalfa cube fed cows	390	499	741
1949	Plasma carotene, cottonseed meal fed cows	133	342	808
"	Plasma carotene, alfalfa cube fed cows	125	286	776
1950	Plasma carotene, cottonseed meal fed cows	263	234	399
"	Plasma carotene, alfalfa cube fed cows	257	219	345
1951	Plasma carotene, cottonseed meal fed cows		205	234
"	Plasma carotene, alfalfa cube fed cows		257	231
1952	Plasma carotene, cottonseed meal fed cows	129	203	601
"	Plasma carotene, alfalfa cube fed cows	142	197	586
1953	Plasma carotene, cottonseed meal fed cows	182	845	868
"	Plasma carotene, alfalfa cube fed cows	142	909	936

1/Plasma carotene in micrograms per 100 milliliters of plasma

It is believed that the high carotene content of the forage in this area in southern New Mexico, may keep the blood carotene and vitamin A of these breeding cows at a sufficient level above the requirements, so that the feeding of additional carotene in dehydrated alfalfa meal shows no increase in blood carotene.

The blood carotene of the cows fed cottonseed meal is well above the requirements, as shown by various workers, indicating no major deficiency over an 8-year period (1946-53, inclusive), even in the most critical years.

OBSERVATIONS ON SALT-MEAL FEEDING OF CATTLE

By J. J. Norris

The use of salt-cottonseed meal mixtures for supplemental feeding of range cattle has become a widespread practice in the Southwest and any observations which might serve to improve the practice are of value. The obvious benefits of salt-meal feeding are savings in labor and the fact that all animals can get adequate amounts of supplement. Less obvious benefits can be realized by judicious location of salt-meal feeding grounds in order to bring about more uniform distribution of livestock over a pasture.

Salt-meal mixtures have been used here on the College Ranch for the last 4 years and certain information of interest has been collected. One interesting question is whether or not limestone might replace or partly replace salt as an inhibitor to consumption of the mixture. The idea considers the limestone in a dual capacity, both as an inhibitor and as a means of supplying calcium to the animals. A summary of some of our findings on the use of limestone in salt-meal mixtures is presented below:

Effect of limestone on consumption of salt-meal mixtures

Number of pounds in Mixture	Amount Consumed Daily	
	Mixture (Lbs.)	Concentrate (Lbs.)
300 concentrate, 67 salt, 33 limestone	4.50	3.37
" " 80 " 20 "	4.00	3.00
" " 90 " 20 "	2.89	2.11
" " 100 " 20 "	2.45	1.75
" " 100 " 0 "	2.18	1.63

It is apparent from the above table that the limestone was of little benefit in inhibiting consumption of the mixture. Consumption of the mixture was highest with the largest amounts (33 pounds) of limestone and the least amount (67 pounds) of salt. Consumption of the mixture was reduced to the lowest figure where the limestone was omitted and salt kept at one-fourth of the mixture. It appears from the last two lines of figures in the table that limestone has a diluting effect on the salt and consumption of the mixture is increased where it is used.

A comparison of hand-feeding of supplements with salt-meal feeding showed no significant differences between the two in cow and calf weights. Table 2 contains data on cattle which were hand-fed compared to that of salt-meal fed cattle.

Table 2.--Effect of salt-meal feeding vs. hand-feeding during calving season on weights of cows and calves

	Hand-fed : C.S. Pellets (Lbs.)	Salt-meal (Lbs.)
Average cow wt., First of season (Feb.15)	990	1044
Average cow wt., End of season (May 19)	903	916
Average cow wt. loss	87	128
Average calf wt., End of season (May 19)	123	126
Average concentrate eaten daily	2.20	1.63

Average cow weight loss was greater on the salt-meal fed cattle, however the difference is not significant since the salt-meal cattle were heavier at the beginning. The salt-meal cattle also consumed considerably less of the supplement than did the hand-fed group. Calf weights at the end of the feeding period were essentially the same. These data show that salt-meal feeding during the calving season has no apparent bad effects on cattle.

A further phase of the local work on salt-meal feeding is its effect on the pattern of grazing in pastures. Obtaining full use of the forage at a distance from watering points without severely abusing the inlying areas is one of the more perplexing problems to the range manager. Various means of evening out the grazing pattern have been used with varying degrees of success, however, judicious location of salt-meal feeding stations away from waters appears to be one of the more successful methods. This subject was discussed in one of the earlier papers and we have some additional information which may be of interest. Table 3 shows forage utilization by one-half mile zones extending out from water in two pastures both before and after salt-meal feeding was used at one mile from the water.

Since only one feeding station was used the utilization data were collected on a half-mile wide belt from the water through the feeding station. Looking first at Pasture 1 before the salt-meal feeding we had 100 percent use within one-half mile of water, then a rapid drop in utilization at greater distances. In the one-half to one mile zone, use was only one-third of full and less than one-sixth at greater distances. After the salt-meal feeding ground was installed the utilization pattern became much more uniform with nearly three-fourths of full use being obtained in the one and one-half to two mile zone. It is evident that the salt-meal feeding exerted a favorable influence on the grazing pattern.

Table 3.--Forage utilization by zones from water before and after provision of outlying salt-meal

	Zones - miles from water			
	0-½	½-1	1-1½	1½-2
Pasture 1				
Before	100.0%	36.9%	18.3%	18.2%
After	100.0%	84.1%	72.7%	74.7%
Pasture 2				
Before	100.0%	73.8%	66.1%	71.5%
After	100.0%	74.4%	65.6%	- - -

Now to look at pasture 2, and we find little difference in the grazing pattern before and after the salt-meal feeding. In both cases utilization was uniform and held up well out to one and one-half miles from the water. The use of salt-meal had no apparent effect. This seeming discrepancy means that some other factor is bringing about uniform use by drawing cattle out from the watering point. In this case a temporary water is located in line with the salt-meal location and the permanent water and draws the animals out during the summer. Where the grazing pattern is relatively uniform over an entire pasture because of any factor, salt-meal feeding can not be expected to improve it to any great extent. Obtaining full use of outlying forage without destructive use near waters simply provides more forage for the livestock.

Summarizing briefly, we found that limestone does not act as an inhibitor to consumption of salt-meal mixtures. Salt-meal feeding during the calving season showed no ill effects on cattle and salt-meal feeding is a valuable tool in drawing cattle away from waters to provide a more uniform pattern of forage utilization. No ill effects have been observed from locating the salt-meal feeding grounds as much as one mile from water.

SUPPLEMENTS FOR RANGE COWS

By J. H. Knox

This project was designed to show whether it is a good practice to feed cows during the critical spring period and what supplements are most profitable to use. Four groups of 24 cows were placed in one pasture about a month before calving started about March 10. Previous work has shown that a mineral supplement should be fed on this range, therefore all cows had access to a mixture of equal amounts of bone meal and salt. The group known as Lot 1 received no other supplement. Lot 2 was fed ground sorghum grain; Lot 3 - cottonseed cake; and Lot 4 dehydrated alfalfa in addition to cake. Thus we have a low protein feed, a high protein feed, and a high protein feed with vitamin A added. The alfalfa meal and cottonseed meal were combined in a cube containing 70 percent cottonseed meal, 23 percent dehydrated alfalfa meal, and 7 percent molasses for the first 5 years. In the last 3 years cottonseed meal and alfalfa were pelleted separately and mixed as fed.

The plan was to feed 1 pound of grain, 1 pound of cake, and 1¼ pounds of mixed cubes until calving started when it was increased to 2 pounds of grain and cake and 2¼ pounds of cubes. This resulted in all the fed cattle getting the same amount of energy and Lots 3 and 4 receiving the same amount of protein.

In the last 2 years the amount of feed was increased slightly because of the poor condition of the range and cattle but the relationships remained the same. After feeding ended the cows were divided into various pastures for breeding with about the same number of cows from each lot in each pasture. After the calves were weaned the cows ran together through the winter.

In order to study the effect of varying weather conditions and to minimize differences which may have existed between lots in the original cows, the work has been conducted for 8 years of which this is the last.

A condensed summary of results is given in table 1, not including the weights of 1953.

Although the differences are not large, the loss in weight of cows decreased as the supplements became more complete in nutrients and the weight of calves increased. Likewise the percent of calves weaned increased, except there was no difference between the grain and cake lots. In production for each cow bred, we find the lot receiving no feed considerably lower and the lot getting cake and alfalfa higher than the others with little difference between the

grain and cake lots. The difference in the number of cows replaced may not be significant but we are inclined to think it is for the cows receiving the protein supplements appeared in somewhat thriftier condition.

Table 1.--Average weights and production for cows receiving different supplemental feed for about 90 days from February to May in the years from 1946 to 1953 inclusive.

Lot Number	1	2	3	4
Ration	Bone Meal-Salt	Bone Meal-Salt, Sorghum grain	Bone Meal-Salt, Cotton-seed Cake	Bone Meal-Salt, Cotton-seed Cake, Alfalfa
Wt. before calving	949	934	930	925
Wt. after calving	887	889	906	916
Loss of wt. in calving season	62	45	24	9
Weaning wt. of calves	389	394	400	405
Percent calves weaned	79	83	83	86
Production per cow*	307	327	332	348
Cows replaced during 8 years	28	27	24	23

*Weight of calves x percent weaned

Before evaluating these feeds we should bear in mind that bone meal was fed to all lots. This supplies phosphorus which has been proved to be the substance most lacking in range feed in New Mexico. This probably accounts for the relatively good showing of the check lot and the small difference between grain and cottonseed cake. Cake is superior to grain in phosphorus as well as protein. Earlier work at this station showed a difference in cow weights of 45 pounds in favor of cake as compared to grain while in this experiment there was only 21 pounds difference. This was probably due to the fact that no mineral supplement was fed in the earlier experiment.

In a previous report it has been stated that neither forage nor blood analyses showed a deficiency in vitamin A during the course of this experiment. Yet considerable and quite consistent advantage was shown for feeding alfalfa which was included to correct a lack of this vitamin. One of our future problems will be to explain why this difference occurred.

The next table illustrates a point of some interest.

The effect of rainfall on the weaning weights of calves from fed and unfed dams

Range Conditions	Bad Years 1948-1950-1951-1952	Fair to Good Years 1946-1947-1949
Av. Annual rainfall	6.68 in.	8.44 in.
Av..Weaning Wt. Calves		
Lot 1	359 lbs.	428 lbs.
Lot 2	372 "	424 "
Lot 3	378 "	430 "
Lot 4	382 "	436 "
Difference between unfed lot and av. of 3 feed lots	18 "	2 "

On the whole feed conditions were unfavorable during most of this experiment but there were 3 years in which they were about average. There seemed to be little advantage for feeding any supplement in addition to minerals in these years.

Conclusions

1. Feeding any of the supplements used improved the weights of both cows and calves.

2. In years when rainfall and feed conditions were average or better the increased weight was not enough to pay the cost of feeding. However, this may be true only when an adequate mineral supplement is fed.

3. Calf production was about as good with grain feeding as with cottonseed cake when bone meal was fed as a source of phosphorus.

4. The use of protein supplements resulted in less loss in weight of cows during the calving season and appeared to have prolonged their usefulness.

5. Alfalfa meal added to cottonseed cake seemed to have a general beneficial effect on the cows and their production although there was no deficiency in vitamin A.